# Pakistan
# Antimicrobial Use Surveillance Strategy
# Human Health
# (2024-2028)

National Institute of Health
ISLAMIC REPUBLIC OF PAKISTAN

# Foreword

Antimicrobial resistance (AMR) is rising globally due to inordinate use of antimicrobials, a profound global health challenge that threatens to reverse decades of medical progress. The World Health Organization (WHO) recognizes AMR as one of the top ten global public health threats, projecting that it could cause up to 10 million deaths annually by 2050 if left unaddressed. Economically, the cost of AMR could reach an alarming $100 trillion by 2050 due to increased healthcare costs, loss of productivity, and prolonged illnesses. Combatting AMR requires coordinated, multisectoral action involving human, animal, and environmental health—the "One Health" approach.

In the context of human health, antimicrobial use (AMU) remains high globally, with significant variations across regions. Recent WHO data reveals that global antimicrobial consumption rates average 14.3 defined daily doses (DDD) per 1,000 inhabitants per day, with some countries exceeding 20 DDD per 1,000 inhabitants per day. High-income countries, such as those in the European Union (EU), have reported a decrease in (AMU) due to stringent stewardship efforts—showing a 23% reduction between 2010 and 2022. In contrast, low- and middle-income countries (LMICs) like Pakistan face challenges such as unregulated AMU and rising levels of AMR.

Pakistan is a high-burden nation for AMR, characterized by widespread misuse and overuse of antimicrobials across healthcare settings. Studies conducted by the National Institute of Health (NIH) of Pakistan show that approximately 70% of all prescribed medicines in the country are antibiotics, marking one of the highest rates in South Asia. WHO underscores the urgent need for Pakistan to develop a robust AMR response, highlighting gaps in surveillance, regulation, and antimicrobial stewardship.

To strengthen regulatory oversight and stewardship, Pakistan's government implemented several initiatives aimed at controlling antimicrobial sales and improving prescribing practices. This includes amongst others pilot projects for Antimicrobial Stewardship Programs (ASPs) in select hospitals, focusing on training healthcare professionals and monitoring prescribing patterns. These initiatives have demonstrated the potential for significant improvements in AMU, but they need to be scaled up for broader impact. Moreover, efforts to raise public and professional awareness about AMR/AMU have also been underway, with the NIH in the lead. These initiatives focus on disseminating guidelines and conducting AMU training sessions for healthcare professionals. However, challenges such as inadequate infrastructure, lack of stakeholder coordination, and limited resources continue to impede progress.

Developing a National AMU Surveillance Strategy is a pivotal step for Pakistan in its fight against AMR. A comprehensive and integrated approach to monitoring AMU across human health sector will not only reinforce national efforts to reduce AMR but also align with global health security objectives. The National Action Plan (NAP) for AMR, developed by Pakistan in 2017 is currently under review and the AMU Surveillance Strategy shall become a part of the revised NAP.

**Dr. Muhammad Salman**
**CEO, NIH**

# Acknowledgements

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# List of Acronyms

| | |
|---|---|
| **AMR** | Antimicrobial Resistance |
| **AMU** | Antimicrobial Use |
| **ASC** | AMU Surveillance Cell |
| **ASP** | Antimicrobial Stewardship Program |
| **AST** | Antimicrobial Susceptibility Testing |
| **BOD** | Burden of Disease |
| **CEO** | Chief Executive Officer |
| **DDDs** | Defined Daily Doses |
| **DRAP** | Drug Regulatory Authority of Pakistan |
| **DTCs** | District technical Committees |
| **EU** | European Union |
| **GAP** | Global Action Plan on AMR |
| **GLASS** | Global Antimicrobial Resistance and Use Surveillance System |
| **HCCs** | Healthcare Commissions |
| **HRA** | Healthcare Regulatory Authority |
| **IPC** | Infection prevention & Control |
| **IWG** | Implementation Working Group |
| **KPIs** | Key Performance Indicators |
| **MoNFS&R** | Ministry of National Food Security and Research |
| **MoNHSR&C** | Ministry of National Health Services, Regulation and Coordination |
| **MRSA** | Methicillin-resistant *Staphylococcus aureus* |
| **NAP** | National Action Plan on AMR |
| **NHA** | National Health Accounts |
| **NIH** | National Institutes of Health |
| **PKR** | Pakistani Rupees |
| **SC** | Steering Committee |
| **SDGs** | Sustainable Development Goals |
| **SSTIs** | Skin and Soft Tissue Infections |
| **SWOT** | Strengths, Weaknesses, Opportunities and Threats |
| **TORs** | Terms of Reference |
| **TWG** | Technical Working Group |
| **WHO** | World Health Organisation |

# 1 Introduction

## 1.1 Overview of the Strategy

Antimicrobial resistance (AMR) and the misuse of antimicrobials (AMU) in human health present critical challenges to Pakistan's healthcare system, undermining treatment outcomes, increasing healthcare costs, and threatening public health security. Irrational prescribing practices, overuse of antimicrobials in both outpatient and inpatient settings, and the over-the-counter availability of antibiotics are widespread drivers of AMR. Studies indicate that approximately 70% of prescriptions in outpatient care include at least one antimicrobial, many of which are unnecessary or inappropriate[1]. This overuse is exacerbated by a lack of national-level data on AMU patterns, making it difficult to track trends or evaluate the effectiveness of stewardship interventions. Despite progress through the National AMR Action Plan (2017-2022)[2], efforts to address AMU in human health have been constrained by the absence of standardized data collection and reporting mechanisms. Furthermore, surveillance data from the World Health Organization's (WHO) Global Antimicrobial Resistance and Use Surveillance System (GLASS) has highlighted the growing prevalence of multidrug-resistant pathogens in healthcare settings in Pakistan[3].

To address these challenges, a strategic and integrated AMU Surveillance Strategy is essential to provide reliable data for evidence-based decision-making, optimize prescribing practices, and strengthen antimicrobial stewardship initiatives. The National AMU Surveillance Strategy for human health focuses on key areas, including standardized data collection from healthcare facilities across all levels, such as hospitals, clinics, and pharmacies. Capacity building for healthcare providers, including physicians and pharmacists, will be prioritized to improve adherence to surveillance protocols and rational prescribing practices. Digital health tools and data analytics will be leveraged to detect patterns of misuse and assess the impact of interventions, providing actionable insights for policymakers and public health professionals. The strategy will also emphasize the integration of AMU surveillance data into national antimicrobial stewardship programs, ensuring a direct link between surveillance findings and policy implementation.

## 1.2 Background

The misuse and overuse of antimicrobials in human health are major contributors to antimicrobial resistance (AMR), identified by the WHO as one of the top ten global public health threats[4]. Inappropriate prescribing, self-medication, and over-the-counter availability of antibiotics in Pakistan have accelerated resistance, creating significant challenges for the healthcare system. According to WHO's GLASS, Pakistan faces critical AMR concerns due to widespread antibiotic misuse and insufficient regulatory enforcement[5].

To strengthen regulatory oversight and stewardship, Pakistan's government has implemented several initiatives aimed at controlling antimicrobial sales and improving prescribing practices. However, enforcement remains inconsistent, leading to widespread over-the-counter sales without prescriptions[6]. Furthermore, pilot projects for Antimicrobial Stewardship Programs (ASPs) have been

[1] Zaidi, S. M., et al. "Patterns of Antibiotic Use in Outpatient Care in Pakistan." *Journal of Global Antimicrobial Resistance*, 2020.
[2] National Institute of Health (NIH). "National Action Plan for Antimicrobial Resistance 2017-2022."
[3] WHO. "GLASS Report 2023: Global Trends in Antimicrobial Resistance and Use."
[4] WHO. "WHO's Ten Global Health Issues for the 2020s."
[5] WHO. "GLASS Report 2023: Global Trends in Antimicrobial Resistance and Use."
[6] Ministry of National Health Services, Regulations, and Coordination, Pakistan. (2023). Regulatory Framework for Antimicrobial Use.

initiated in select hospitals, focusing on training healthcare professionals and monitoring prescribing patterns. These initiatives have demonstrated the potential for significant improvements in AMU, but they need to be scaled up for broader impact[7]. Moreover, efforts to raise public and professional awareness about AMR have also been underway, with NIH in the lead. These initiatives focus on disseminating guidelines and conducting AMU training sessions for healthcare professionals[8]. Another key component of ongoing efforts has been the Point Prevalence Surveys (PPS) methodology, which has been implemented in human health (HH) sector to ascertain AMU patterns. These surveys provide crucial data that allow stakeholders to understand current usage patterns, identify areas of concern, and develop targeted interventions. The PPS data has been instrumental in highlighting the misuse and overuse of antimicrobials, thus setting the stage for more informed decision-making and policy development[9].

However, despite these efforts, challenges such as inadequate infrastructure, lack of stakeholder coordination, and limited resources continue to impede progress. The AMU Surveillance Strategy (Human Health) is likely to guide future interventions and resource allocations for this important cause.

## 1.3 Rationale:

**Global Context**: The WHO Global Action Plan (GAP) on AMR and the UNGA High-Level Meeting (HLM) declarations emphasise the urgent need for coordinated AMR and AMU surveillance systems to collect and analyse data. In addition, the WHO GLASS Antimicrobial Consumption (AMC) module sets benchmarks for AMU data collection, providing guidance on metrics for monitoring and reporting; and its adherence is important for Pakistan like the rest of the countries.

**National Context**: Pakistan has one of the highest rates of antibiotic consumption globally, driven by self-medication, overprescribing, and weak regulatory frameworks. Studies report that approximately 70% of antibiotic prescriptions in Pakistan are issued without clinical justification, exacerbating AMR risks. Moreover, inadequate policy and public awareness and gaps in the healthcare system contribute to suboptimal antimicrobial stewardship.

**Health and Economic Burden**: AMR contributes to an estimated 20,000 annual deaths in Pakistan due to resistant bloodstream infections. Treatment costs for AMR-related hospitalizations are 50% higher, significantly burdening the healthcare system.

**Alignment with SDGs**: AMR threatens progress towards Sustainable Development Goals (SDGs), particularly Goal 3, which emphasizes health and well-being. Addressing AMU is critical for achieving targets related to child mortality reduction, communicable disease control, and universal health coverage.

Finally, Pakistan is already reporting to **WHO's GLASS**, however, further efforts to enhance data collection and reporting standards is essential[10].

## 1.4 Purpose & Objectives

**Purpose:** To establish a robust antimicrobial use surveillance system that supports evidence-based policymaking, strengthens antimicrobial stewardship, and aligns with international standards.

[7] Fleming Fund Country Grant, Pakistan. (2023). Pilot Projects on Antimicrobial Stewardship Programs.
[8] National Institute of Health, Pakistan. (2023). Public and Professional Awareness Initiatives on AMR.
[9] National Institute of Health, Pakistan. (2022). Point Prevalence Surveys on Antimicrobial Use.
[10] WHO GLASS, "Antimicrobial Resistance Surveillance in Pakistan," *GLASS Annual Report*, 2024.

**Objectives:** 1) To monitor patterns of antimicrobial use in healthcare settings. 2) To provide evidence for policy and regulatory interventions. 3) To enhance capacity for data collection and reporting, aligned with the WHO GLASS AMC module. 4) To support rational antimicrobial prescribing practices through data-driven decision-making.

## 1.5 Scope of the Strategy

The strategy encompasses all levels of healthcare delivery, including:

- **Public Sector**: Hospitals, clinics, and community health programs.
- **Private Sector**: Private healthcare providers and pharmacies.
- **Regulatory Entities**: Oversight by **NIH**, **DRAP**, **HRA**, **HCCs**, and provincial health departments.
- **Data Integration**: Alignment with **WHO's GLASS** and assess the possibility of integration in DHIS2.

## 1.6 Intended Users

The strategy is designed to target:

- Policymakers and regulators at the federal, provincial and district levels.
- Healthcare providers across the public and private health sector, including hospitals, clinics, and pharmacies.
- Human Health related academic and research institutions.
- International partners, including WHO, Fleming Fund, and CDC.

## 1.7 Preparation of National AMU Surveillance Strategy

The steps undertaken in the preparation of the National Antimicrobial Use (AMU) Surveillance Strategy for Human Health of Pakistan are depicted in Figure 1.

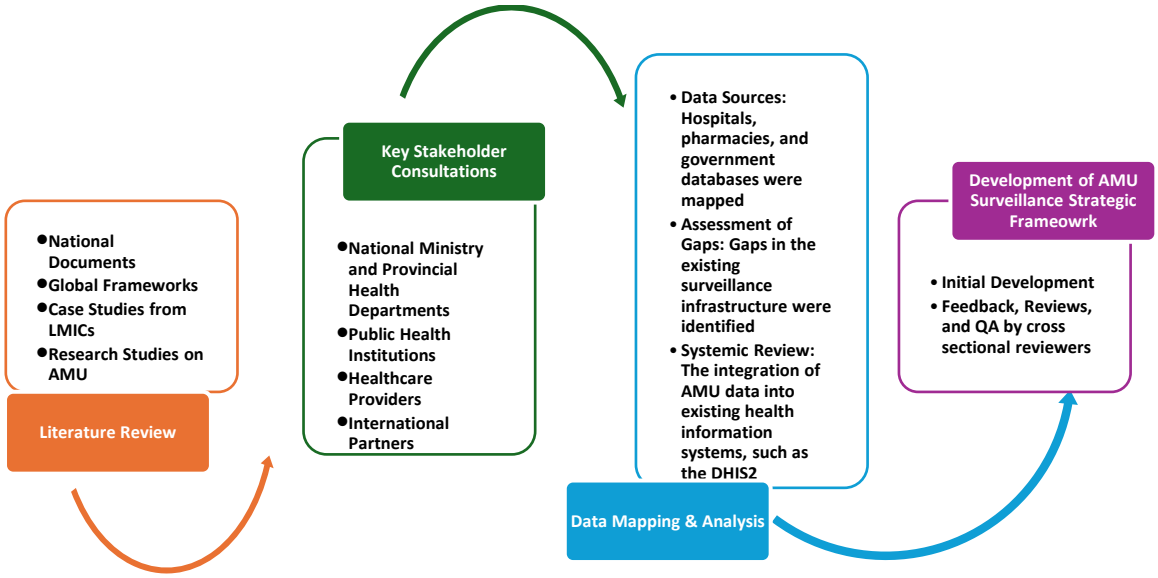
National Documents
Global Frameworks
Case Studies from LMICs
Research Studies on AMU
Literature Review
Key Stakeholder Consultations
National Ministry and Provincial Health Departments
Public Health Institutions
Healthcare Providers
International Partners
Data Sources: Hospitals, pharmacies, and government databases were mapped
Assessment of Gaps: Gaps in the existing surveillance infrastructure were identified
Systemic Review: The integration of AMU data into existing health information systems, such as the DHIS2
Data Mapping & Analysis
Development of AMU Surveillance Strategic Frameowrk
Initial Development
Feedback, Reviews, and QA by cross sectional reviewers

*Figure 1: Steps undertaken in the Preparation of AMU Surveillance Strategy*

The preparation undertook review of credible global and national literature, integrates consultations at the national and provincial level, and maps the current data sources at the national and sub-national levels extracting key insights for the strategic framework development requirements.

Moreover, the preparation involved a fully consultative and collaborative process under the stewardship of National Institute of Health (NIH).

# 2 Situation Analysis

## 2.1 Global Situation of Antimicrobial Use

Antimicrobial resistance, driven primarily by excessive and inappropriate use of antimicrobials, represents an urgent global health crisis that threatens to erode decades of progress in medicine. The WHO has highlighted AMR as one of the top ten global public health threats, with projections indicating it could result in as many as 10 million deaths annually by 2050 if left unchecked[11]. This alarming trend is compounded by economic forecasts suggesting AMR could cost up to $100 trillion by mid-century due to rising healthcare costs, reduced productivity, and prolonged illness associated with resistant infections[12]. Addressing AMR effectively requires a One Health approach that recognizes the interconnected roles of human, animal, and environmental health[13].

In human health, the demand for antimicrobial medications remains high worldwide, though usage rates vary significantly across regions. WHO data indicate that global antimicrobial consumption averages around 14.3 defined daily doses (DDD) per 1,000 inhabitants per day, with several countries reporting much higher usage—exceeding 20 DDD per 1,000 inhabitants daily in some regions lacking regulatory controls and stewardship programs[14]. High-income countries, such as those in the European Union (EU), have made strides in reducing AMU, achieving a 23% reduction between 2010 and 2022 through strong stewardship programs and regulatory measures[15]. In contrast, low- and middle-income countries (LMICs) face considerable challenges due to unregulated access to antimicrobials, weak prescription controls, and widespread self-medication practices[16].

In LMICs, the lack of regulatory oversight allows easy access to antimicrobials without a prescription, contributing to inappropriate and excessive use. CDC data shows that antimicrobial consumption in LMICs has surged by 65% over the past two decades, driven by factors such as increased economic access, rapid urbanization, and expanding retail pharmaceutical markets[17]. In Pakistan, AMU is among the highest globally, with antimicrobials frequently available over the counter and prescribed at high rates in both urban and rural areas. Pakistan's antibiotic consumption exceeds 20 DDD per 1,000[18] inhabitants per day on average, with antibiotics accounting for nearly half of all prescriptions[19].

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[11] World Health Organization. (2022). *Global Action Plan on Antimicrobial Resistance*. Available at: https://www.who.int/.
[12] O'Neill, J. (2016). *Tackling Drug-Resistant Infections Globally: Final Report and Recommendations*. Review on Antimicrobial Resistance.
[13] WHO Global Antimicrobial Resistance and Use Surveillance System (GLASS). (2023). *AMU Report 2022-23*. Available at: https://www.who.int/.
[14] European Centre for Disease Prevention and Control. (2023). *Antimicrobial Use in Europe: Annual Epidemiological Report 2022*. ECDC.
[15] Centres for Disease Control and Prevention. (2022). *Antibiotic Use and Resistance in LMICs*. CDC.
[16] Ahmad, S., Ahmed, A., & Saeed, F. (2021). Patterns of Antibiotic Use in Pakistan and Implications for Health Policy. *Pakistan Journal of Medical Sciences*, 37(4), 923–930.
[17] WHO GLASS Report. (2023). *Antimicrobial Consumption in the EU/EEA: Annual Epidemiological Report*. Available at: https://www.who.int/.
[18] https://pmc.ncbi.nlm.nih.gov/articles/PMC10732562/
[19] CDC National Action Plan for Combating Antibiotic-Resistant Bacteria (2020–2025). Available at: https://www.cdc.gov/.

In contrast, high-income countries have implemented robust antimicrobial stewardship programs, significantly curbing antimicrobial use (AMU). The CDC reports that in the United States, antimicrobial use in outpatient settings decreased by approximately 10% from 2012 to 2020 due to improved stewardship, better diagnostic practices, and a reduction in unnecessary prescriptions, especially for respiratory infections[20]. Similar trends are noted in Europe, where surveillance data from the WHO's GLASS reveal ongoing reductions in AMU through consistent regulatory enforcement and awareness initiatives[21].

Finally, the economic impact of widespread antimicrobial use and rising resistance levels is substantial. WHO estimates that the global economic cost of AMR could surpass $1 trillion annually by 2050, disproportionately burdening LMICs, where healthcare resources are often scarce[22]. Additionally, AMR threatens to exacerbate poverty levels, with an estimated 24 million people projected to fall into extreme poverty by 2030 due to AMR-related health and economic challenges[23].

## 2.2 National Situation of Antimicrobial Use

Pakistan faces a critical public health threat in the form of AMR, which is driven by the widespread misuse and overuse of antimicrobials in both human and animal health sectors. The National Institute of Health (NIH) estimates that 60% of all prescribed medicines in Pakistan are antibiotics, marking one of the highest rates in South Asia[24]. A WHO report from 2021 continues to underscore the urgency for Pakistan to develop a comprehensive response to AMR, highlighting gaps in surveillance, regulation, and antimicrobial stewardship efforts[25].

Recent evaluations of AMR efforts globally, including those from the Global Burden of Disease Study 2022, estimate that over 1.27 million deaths were directly attributable to drug-resistant infections, with South Asia being one of the hardest-hit regions[26]. Pakistan is similarly facing this growing health crisis, particularly in critical healthcare environments such as intensive care units (ICUs) and neonatal care units, where infections with multidrug-resistant organisms are becoming increasingly common[27].

A recent evaluation by Fleming Fund (2023) also flagged several key challenges, including a lack of trained healthcare professionals in AMR/AMU management, inadequate laboratory facilities for proper diagnostics, and limited public and professional awareness of the importance of judicious antimicrobial use[28]. Furthermore, self-medication remains a major concern in Pakistan, with studies showing that over 50% of the population regularly engages in the practice, contributing to the high rates of antibiotic misuse[29].

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[20] World Bank. (2017). *Drug-Resistant Infections: A Threat to Our Economic Future*. World Bank Report.
[21] World Health Organization. (2021). *Impact of Antimicrobial Resistance on Poverty*. Available at: https://www.who.int/.
[22] Food and Agriculture Organization of the United Nations. (2022). *Antimicrobial Resistance and Food Safety*. FAO.
[23] World Health Organization. (2019). *No Time to Wait: Securing the Future from Drug-Resistant Infections*. Interagency Coordination Group on AMR.
[24] NIH Pakistan, "Antibiotic Use in Pakistan: A Review," National Institute of Health, 2022.
[25] WHO, "Global Antimicrobial Resistance Report 2021," World Health Organization, 2021.
[26] Antimicrobial Resistance Collaborators, "Global burden of bacterial antimicrobial resistance in 2022: a systematic analysis," *The Lancet*, 2023.
[27] Khan, M. A., et al., "Multidrug Resistance in Pakistan's ICUs: An Urgent Health Crisis," *Journal of Critical Care Medicine*, 2022.
[28] WHO, "AMR and One Health Approach: Pakistan's Roadmap," 2023.
[29] Afzal, M. S., et al., "Self-Medication Practices in Pakistan: A Systematic Review," *Global Health Journal*, 2023.

Moreover, Pakistan has one of the highest rates of antibiotic use/consumption in the world, driven by unregulated sales and frequent overprescribing. As of 2021, antibiotic consumption per capita in Pakistan was among the highest in Asia, with approximately 70% of prescriptions issued without proper clinical justification[30]. Urban areas report that nearly 40% of antibiotic use is through self-medication, exacerbating resistance trends[31]. Despite some progress under the National AMR Action Plan (2017)[32], critical gaps remain in surveillance systems, public awareness, and regulatory enforcement. A 2021 survey found that nearly 50% of the population remains unaware of AMR's implications, underscoring the need for targeted awareness campaigns[33]. Unchecked AMR threatens progress toward achieving the Sustainable Development Goals (SDGs), particularly Goal 3, which emphasizes reducing child mortality, controlling communicable diseases, and achieving universal health coverage. Addressing antimicrobial misuse is vital for achieving targets like reducing neonatal and child mortality (SDG 3.2) and ensuring access to safe, effective medicines (SDG 3.8)[34].

In addition, the health and economic consequences of AMR in Pakistan are severe. AMR-related bloodstream infections result in over 20,000 deaths annually, while resistant infections increase hospitalization costs by an estimated 50%[35]. The WHO projects that, without intervention, AMR could cause 10 million deaths globally each year by 2050, with low- and middle-income countries like Pakistan disproportionately affected[36].

To address these challenges, the revision of Pakistan's NAP is expected to introduce several key initiatives: the establishment of robust AMR surveillance systems, AMU Surveillance System, stronger regulatory frameworks to control antimicrobial use (AMU), and enhanced public health campaigns to increase awareness. In the agriculture and veterinary sectors, new regulations will focus on curbing the non-therapeutic use of antibiotics, particularly as growth promoters in livestock and poultry farming, which have been identified as major contributors to AMR[37]. Despite these efforts, issues such as inconsistent enforcement of regulations and the continued over-the-counter availability of antimicrobials, specifically antibiotics (low molecular substance produced by microorganisms and inhibits or kills other microorganism), without prescriptions remain significant challenges. A study from 2022 highlighted that Pakistan ranks among the top consumers of antibiotics globally, with the problem exacerbated by poor regulatory controls[38]. Moreover, pilot projects focused on Antimicrobial Stewardship Programs (ASPs) in select hospitals have demonstrated potential for improving prescribing patterns, but these efforts need to be expanded across the country to achieve broader impact[39].

A **SWOT analysis** (Table 1) was conducted to identify key strengths, weaknesses, opportunities and threats within the Health Ecosystem in Pakistan focusing on AMU Surveillance gaps. This was used to guide the development of the AMU Human Health Surveillance Strategic Framework key requirements.

[30] Zaidi, S. M., et al. "Patterns of Antibiotic Use in Outpatient Care in Pakistan." *Journal of Global Antimicrobial Resistance*, 2020.
[31] Khan, M. S., et al. "Self-Medication with Antibiotics in Urban Pakistan." *Frontiers in Public Health*, 2021.
[32] National Institute of Health (NIH). "National Action Plan for AMR 2017-2022."
[33] Gallup Pakistan. "Public Awareness Survey on Antimicrobial Resistance," 2021.
[34] United Nations. "Sustainable Development Goals: Goal 3," 2015.
[35] Center for Disease Dynamics, Economics & Policy (CDDEP). "The State of AMR in Pakistan," 2021.
[36] WHO. "No Time to Wait: Securing the Future from Drug-Resistant Infections," 2019.
[37] Government of Pakistan, "Regulation of Antimicrobial Use in Agriculture: 2024 Draft Policy," 2024.
[38] Waqas, M., et al., "Global Antibiotic Consumption: Trends and Future Outlook," *Journal of Infection Control*, 2022.
[39] Zafar, A., et al., "Antimicrobial Stewardship in Pakistan: Progress and Challenges," *Infection Prevention Journal*, 2023.

*Table 1: SWOT Analysis for the development of AMU Surveillance Strategy*

| Strengths | Weaknesses |
|---|---|
| • **Expansion of Surveillance Initiatives:** The GLASS system, introduced in Punjab and Sindh, is progressively expanding to cover more provinces, which improves the nationwide AMR data collection and trend analysis of AMU. This expansion supports evidence-based decision-making for AMR interventions (WHO's Global Antimicrobial Resistance and Use Surveillance System (GLASS) Report 2023).<br>• **Laboratory Infrastructure and Capacity:** There is an increasing number of labs capable of conducting Drug Susceptibility Testing (DST) across various health levels, supported by WHO capacity-building programs. Additionally, several labs are quality-assured, increasing the reliability of surveillance data (WHO's Global Antimicrobial Resistance and Use Surveillance System (GLASS) Report 2023; NIH Pakistan Annual Report 2023).<br>• **Educational and Research Capacity:** Academic and research institutions like the NIH, PARC and PHRC are actively engaged in AMR-specific training and capacity building, leveraging collaborations with global partners to bolster local expertise in AMR management (NIH Pakistan Annual Report 2023; HEC. (2023). Higher Education Commission, Pakistan: Updates on AMR-Related Research and Training).<br>• **Regulatory Framework:** Healthcare Commissions (regulatory authorities) in KP, Punjab, and Sindh are implementing initiatives to regulate antibiotic usage through development of treatment guidelines, EPHS and MSDS. For instance, DRAP has introduced a Voluntary Ethical Marketing Code that promotes ethical antibiotic marketing, aiding in the containment of AMR at multiple levels (DRAP, 2022).<br>• **One Health Framework:** Increased collaborations between human, animal, and environmental health sectors strengthen AMR initiatives and data collection. These collaborations, including the One Health framework, aim to monitor zoonotic AMR transmission paths, helping to prevent cross-species transmission and support holistic AMR efforts (One Health Pakistan, 2023). Development of the One Health forum/network on the National and Provisional level is a key step.<br>• **Strategic Guidelines for Standardization:** Adoption of WHO GLASS protocols and DRAP's | • **Funding and Resource Constraints:** Limited funding restricts full implementation of the AMR framework, affecting the scope of comprehensive diagnostics and surveillance activities across Pakistan (World Bank, 2022).<br>• **Shortage of Trained AMR Professionals**: Gaps remain in the availability of AMR-trained professionals, particularly lab technicians, and epidemiologists. Additionally, outdated AMR curricula fail to prepare healthcare professionals adequately for current AMR challenges, reducing the effectiveness of healthcare delivery (HEC, 2022; FELTP, 2023).<br>• **Lack of Coordinated Data Oversight:** The absence of a central data repository for AMR surveillance means inconsistencies in data-sharing and reporting at both the national and provincial levels, complicating efforts to track AMR trends and implement interventions effectively (NIH, 2023).<br>• **Inconsistent Laboratory Standards:** The absence of a national proficiency testing program and varied methodologies in laboratories compromise the quality and uniformity of AMR testing, impacting the reliability of surveillance data (WHO GLASS, 2023).<br>• **Easy Over-the-Counter Antibiotic Access:** Unregulated sale of antibiotics remains a critical issue, with limited prescription control allowing misuse in human and veterinary sectors. This unchecked access contributes significantly to the development of resistance (DRAP, 2022). |

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|---|---|
| regulatory guidelines supports a standardized approach to data collection, facilitating data consistency across sectors. This framework ensures comparability of AMR data, crucial for informed policy decisions (WHO GLASS, 2023; DRAP, 2022).<br>• **Growing Trained Workforce:** Over the past five years, the number of trained ID physicians and microbiologists has significantly increased, providing the necessary human resources for effective surveillance and clinical management of AMR cases (HEC, 2023; NIH, 2022). | |
| **Opportunities** | **Threats** |
| • **Public Awareness and Education**: The proliferation of internet and media provides platforms for public AMR literacy campaigns, improving advocacy and empowering the public to make informed choices about antibiotic use (*WHO, 2023*).<br>• **Infection Prevention and Control (IPC):** Recent access to donor support, PPE, and WHO-aligned guidelines lays a foundation for strengthening IPC protocols in healthcare settings, enhancing the effectiveness of AMR mitigation (*WHO IPC, 2023*).<br>• **Expansion of Vaccination Programs:** With strengthened vaccine production capacity, increased public awareness, and better distribution networks, vaccination programs are helping prevent infections, thereby reducing unnecessary antibiotic use. Institutions like NIH are central to these developments (*NIH, 2023*).<br>• **Public Health and One Health Integration:** Opportunities for NIH and FELTP-trained professionals to expand One Health principles in AMR surveillance can support tracking and managing zoonotic AMR risks, a critical aspect given Pakistan's high reliance on livestock (*One Health Pakistan, 2023*).<br>• **Sustainable Agriculture and Animal Health Practices:** Improved standards for hygiene and veterinary practices, backed by One Health frameworks, reduce the AMR risk from animal-to-human transmission, ensuring a holistic approach to AMR (PARC, 2023). | • **Data Integration and Coordination Challenges:** Limited interprovincial data-sharing frameworks, lack of a centralized AMR coordination body, and reluctance to share AMR data among institutions hinder the integration of surveillance efforts (NIH, 2023).<br>• **Diagnostic and Stewardship Gaps:** Limited use of a harmonized analysis tool such as the WHONET software, constrained access to AST results, and lack of uniform lab protocols reduce the quality and standardization of AMR surveillance (WHO, 2023).<br>• **Weak Infection Prevention and Control (IPC) Systems:** National IPC standards are largely unimplemented, and a lack of comprehensive IPC programs in healthcare facilities undermines efforts to contain AMR. Additionally, many hospitals lack vaccinated healthcare workers (World Bank, 2022).<br>• **Hygiene and Sanitation Infrastructure Deficiencies:** Insufficient sanitation systems and limited potable water access in several regions increase the risk of infections, underscoring the need for robust IPC integration (World Bank, 2023).<br>• **Legislative and Financial Limitations:** Limited political commitment to AMR initiatives, alongside insufficient funding and weak AMR-related policy enforcement, hampers the sustainability and effectiveness of AMR mitigation efforts (DRAP, 2022). |

**Human Health Sector Budgetary Trends:**

According to Pakistan's *National Health Accounts 2021*, the total health expenditure was approximately PKR 1,950 billion, representing around 3.2% of GDP. Within this budget, allocations for

public health initiatives, including infectious disease control, remain limited. For the 2021-2022 fiscal year, the National Health Ministry allocated PKR 138 billion to the healthcare budget, of which approximately PKR 24 billion was directed toward public health programs and infectious disease surveillance. At the provincial level, budgets across Punjab, Sindh, Khyber Pakhtunkhwa, and Balochistan also contribute to healthcare funding, with Punjab allocating PKR 369 billion, Sindh PKR 179 billion, Khyber Pakhtunkhwa PKR 146 billion, and Balochistan PKR 46 billion for health services. However, within these allocations, the focus on preventive health, including Antimicrobial Use (AMU) surveillance, remains limited and requires further strengthening to address AMR and AMU effectively.

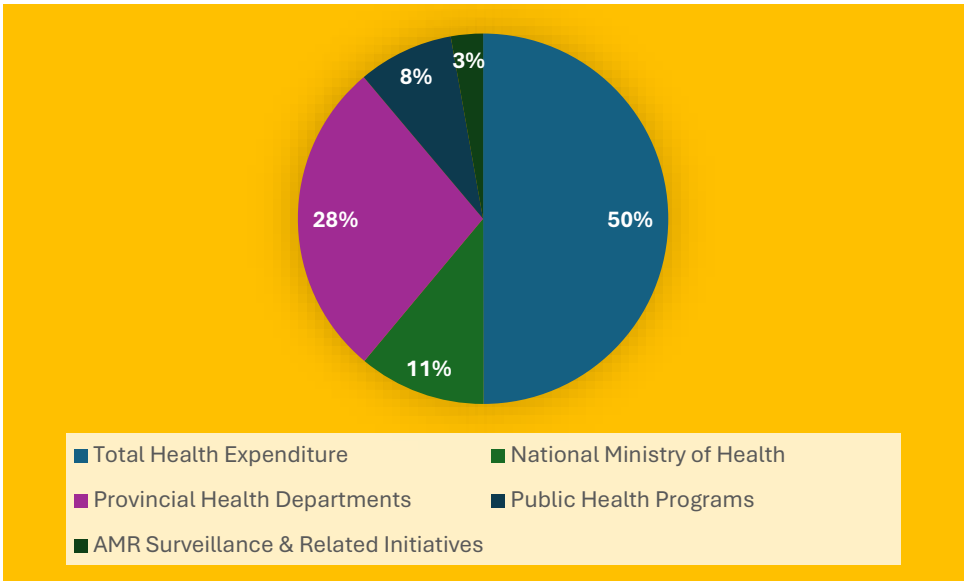


*Figure 2: Percentage of Expenditures by Categories*

While provincial health departments hold substantial portions of the health budget[40], the fiscal space for AMU remains limited due to competing priorities. Most health budgets are absorbed by curative services, leaving preventive health, including AMU surveillance, underfunded.

Out-of-pocket (OOP) expenditures make up a significant portion of health spending, accounting for approximately 56.2% of total healthcare expenditure according to the *National Health Accounts 2021* (Pakistan Bureau of Statistics, 2021). This high dependence on OOP payments directly impacts accessibility to essential health services and medications, especially antibiotics, which are easily accessible for over-the-counter purchase. According to estimates from the Pakistan Economic Survey 2022 and the *National Health Accounts 2021*, expenditures on medicines alone account for approximately 51.1% of OOP health spending, amounting to an estimated PKR 484 billion annually. Within this category, antibiotics alone consume roughly 13-15% of OOP spending, equating to PKR 63-72 billion in direct costs borne by households.

This high spending on antibiotics highlights their pervasive demand, often used without appropriate medical guidance. Such widespread, unsupervised use contributes significantly to antimicrobial resistance (AMR) due to self-medication and inconsistent adherence to treatment protocols. Addressing this issue is critical, necessitating a coordinated AMU surveillance strategy that emphasizes monitoring of antibiotic consumption, curbing OOP-driven self-medication practices, and developing public awareness campaigns to reduce the potential for AMR threats.

[40] Provincial Health Departments Annual Budgets (2021-2022).

- **Out-of-Pocket (OOP) Expenditure**: The heavy reliance on OOP expenditure—approximately 3.4% of total health spending[41]—highlights the insufficient public funding available for preventive health, creating a barrier to AMU surveillance funding.

- **Dependency on Donor Funding**: AMU-related projects are likely to be supported by international donors like the Fleming Fund and WHO. Sustainable fiscal space for AMU, however, necessitates increasing domestic budget allocations to ensure continuity and local ownership.

**Fiscal Space for AMU Surveillance Strategy in Pakistan:**

The fiscal space available for implementing the AMU Surveillance Strategy in Pakistan hinges on the recent allocations by both the federal and provincial governments. Based on the *National Health Accounts 2021*, approximately 3.4% of GDP is allocated to health expenditures, with a significant proportion aimed at primary and secondary healthcare services. However, targeted funding for AMU remains limited. (Table 2)

*Table 2: Health Expenditure Distribution (Federal and Provincial Levels) FY 2021-22 (Source: National Health Accounts 2021, Pakistan Bureau of Statistics)*

| Category | Federal Allocation (PKR Billion) | Provincial Allocation (PKR Billion) | Total (PKR Billion) |
|---|---|---|---|
| Primary and secondary care | 75.5 | 105.7 | 181.2 |
| Public health programs | 32.2 | 48.3 | 80.5 |
| Health information systems | 8.4 | 15.2 | 23.6 |
| Research and development | 5.1 | 9.7 | 14.8 |
| **Total Health Expenditure** | **121.2** | **178.9** | **300.1** |

*Table 3: Current AMU Surveillance-Specific Budgetary Allocation (Source: National Health Accounts 2021, Pakistan Bureau of Statistics 2021-22)*

| Budget Category | Federal Allocation (PKR Million) | Provincial Allocation (PKR Million) | Total (PKR Million) |
|---|---|---|---|
| Infrastructure development | 5,000 | 10,000 | 15,000 |
| Surveillance and monitoring systems | 3,000 | 6,000 | 9,000 |
| Training and capacity building | 2,500 | 4,000 | 6,500 |
| Public awareness campaigns | 1,500 | 3,000 | 4,500 |
| Total | 12,000 | 23,000 | 35,000 |

[41] National Institute of Health Pakistan. (2021). *National Health Accounts of Pakistan 2021*.

Table 3 outlines the estimates for the current indirect AMU surveillance-specific allocations for infrastructure, monitoring systems, training, and awareness campaigns. A total of PKR 35,000 million is designated for these initiatives, with provincial contributions comprising the larger portion.

A core consideration throughout the budgeting process was to avoid the risks associated with developing an over-ambitious roadmap. Overestimating program needs could jeopardize implementation quality and place undue strain on resources, potentially leading to gaps in execution. Therefore, each budgetary element was evaluated to ensure a balance between ambition and feasibility, allowing the AMU Surveillance Strategy to be both impactful and achievable. To maintain flexibility, budgetary projections are designed as adaptable benchmarks that can be refined over time. Annual work plans will incorporate these projections and adjust allocations based on the evolving financial landscape and the availability of new data on funding streams and resource inflows. This adaptive approach will allow the AMU Surveillance Strategy to remain responsive to changes, ultimately enhancing its sustainability and effectiveness over time.

The proposed budget for implementing the 5-Year AMU Surveillance Strategy in Pakistan has been carefully estimated using proxy allocations across various program categories (Table 4). This approach aimed to align the strategy with available fiscal space while addressing key components essential for robust AMU surveillance, including human resources, infrastructure, capacity building, data management, and community engagement. The budgeting process was undertaken with an understanding of current resource constraints, emphasizing a realistic yet effective allocation that supports sustainable implementation over the five-year period.

*Table 4: Proposed Budget Allocation for 5-year AMU Surveillance Strategy 2025-30 (Federal & Provincial) - Source: National Health Ministry, Fiscal Year Proposals 2024-25.*

| Surveillance Component | Federal Allocation (PKR Million) | Provincial Allocation (PKR Million) | Total (PKR Million) |
|---|---|---|---|
| Data Collection & Analysis | 200 | 350 | 550 |
| Laboratory Strengthening | 180 | 320 | 500 |
| Capacity Building | 90 | 160 | 250 |
| Public Awareness Campaigns | 75 | 125 | 200 |
| Monitoring & Evaluation | 40 | 70 | 110 |
| **Total AMU Budget** | **585** | **1,025** | **1,610** |

# 3 Implementation Structure

## 3.1 Uniformity with the Global & National Approach

The implementation structure is guided by the bottom-up approach of data flow from Healthcare Facilities to district, from district to provincial and from provincial to national level. It also considers the data flow adopted for the AMR Surveillance in Human Health AMR Surveillance Strategy to avoid unparalleled information, and benchmarking uniformity in approach, since both strategic documents shall become part of the National Action Plan. Figure 3

The strategic framework also takes guidance from the WHO GLASS Manual (2023) on the management of antimicrobial consumption / use data.

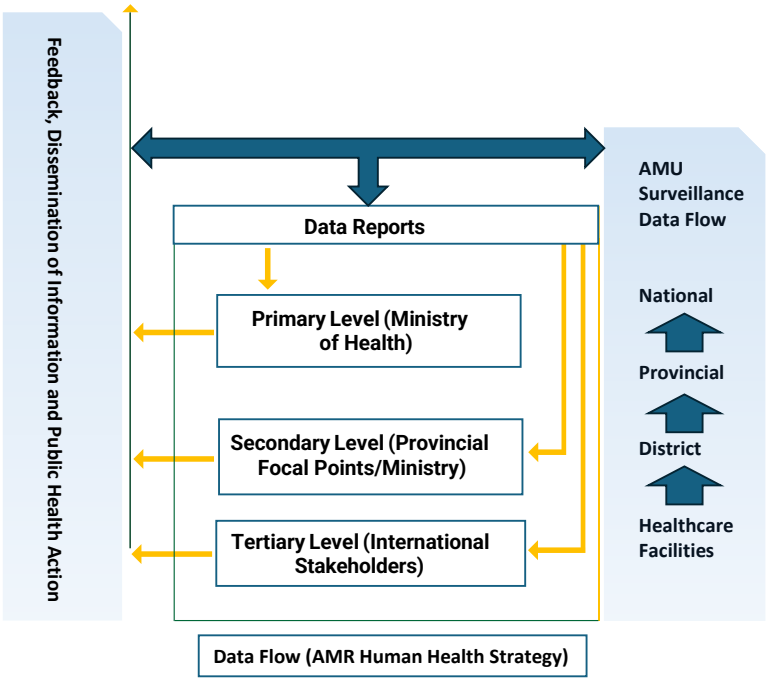


*Figure 3: Data Flow for AMU Surveillance (Human Health) in line with AMR Surveillance Strategy (Human Health)*

Further, the implementation structure for Pakistan's AMU Surveillance Strategy in human health focuses on coordinated, multi-tiered management, data-driven monitoring, and stakeholder engagement to support effective and sustainable antimicrobial use (AMU) surveillance. Key components include oversight, collaborative technical groups, local implementation teams, and standardized monitoring and evaluation (M&E) processes. This structure aligns with global AMU surveillance best practices and ensures consistent data collection and reporting. Figure 4

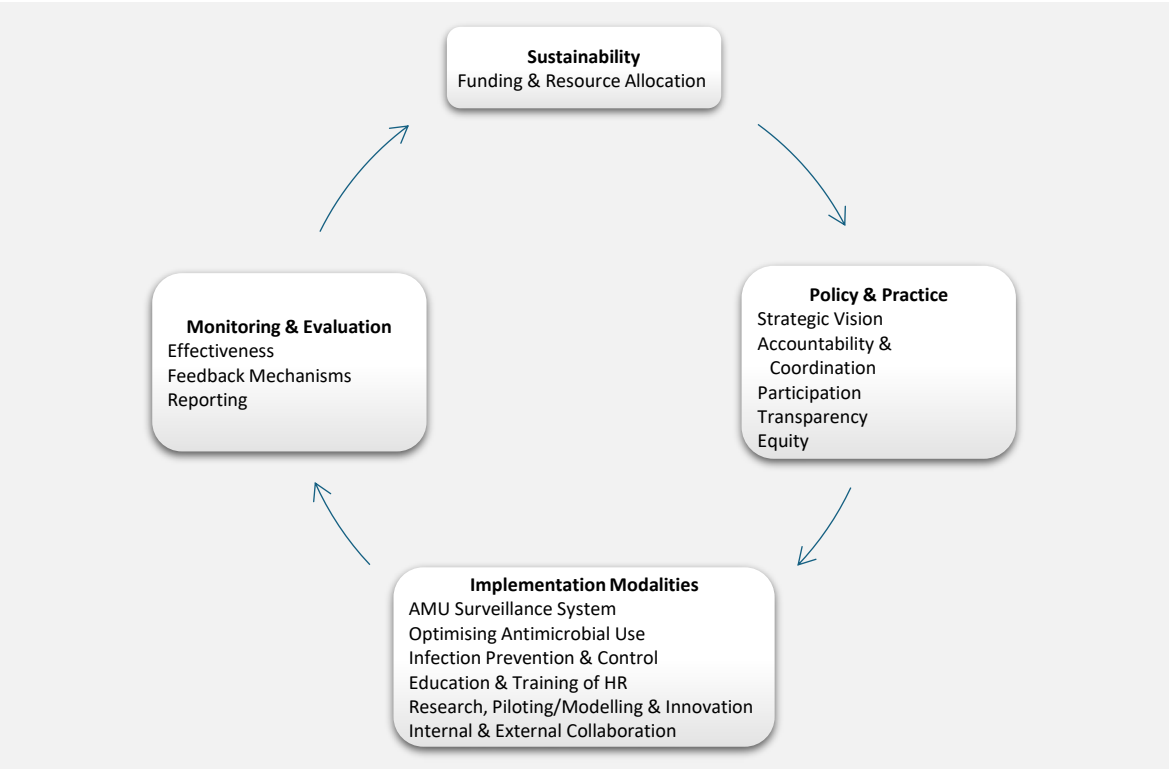


*Figure 4: Guidance from Global Human Health AMU Surveillance National Action Plans*

## 3.2 Monitoring Mechanisms of AMU Surveillance Strategy

1. **Oversight and Coordination Mechanisms**

- **Steering Committee (SC):** The SC will be a high-level, multi-sectoral body at the Federal level with representatives from relevant ministries, such as health, education, water and sanitation, and socio-economic development. Its role shall focus on:

    - Overseeing AMU policy direction and multi-sectoral coordination.
    - Reviewing quarterly progress on the AMU Surveillance Strategy.
    - Providing recommendations to planning and development authorities for improved action plans.
    - Ensuring field operatives maintain competencies and strong linkages across district and facility levels.

- **AMU Surveillance Cell (ASC):** Located within the National Institute of Health (NIH) will serve as the administrative and coordination hub for AMU surveillance. Responsibilities include:

    - Supporting the SC with technical and administrative tasks.
    - Coordinating with provincial and district implementation groups.
    - Consolidating and aggregating data for high-level reporting.
    - Ensuring quality control in data collection and reporting procedures.

2. **Technical and Implementation Support Structures**

- **Technical Working Groups (TWGs):** The TWGs based at the provincial level will provide specialized technical support and resource mobilization. The group's responsibilities include:

    - Mobilizing technical resources, developing protocols, and formulating terms of reference (TORs) for AMU consultants.
    - Providing training plans, identifying master trainers, and overseeing the dissemination of surveillance protocols.
    - Meeting monthly to review technical challenges, guide data collection, and ensure high-quality AMU monitoring across districts.
    - Reviewing monthly or quarterly progress on strategy implementation.
    - Conducting evaluations and rapid surveys to address emerging issues in AMU surveillance.
    - The TWG will collaborate closely with the ASC to resolve any policy-level issues.

3. **Monitoring, Evaluation, and Reporting**

- **Annual and Quarterly Review Processes:** To maintain effective oversight, the following review structures will be established:

    - **Annual Review:** Chaired by high-ranking officials from the Ministry of National Health Services, Regulation and Coordination, NIH and all provincial DOH, this review will assess the previous year's performance, approve the Rolling Action Plan for the upcoming year, and share the findings with stakeholders. Ideally this task can be assigned to the Steering Committee.
    - **Quarterly Reviews:** Coordinated by the ASC, quarterly reviews will assess short-term progress, update rolling action plans, and provide corrective guidance as needed.

4. **Planning and Budget Integration**

- **Rolling Action Plan:** A Rolling Action Plan will be the primary planning and monitoring tool for the AMU Surveillance Strategy. This plan will align short-term actions with Pakistan's budgetary and planning cycles, across three project categories:

    - **List A:** Ready-to-implement projects with approved details.
    - **List B:** Projects requiring additional planning or refinement.
    - **List C:** Conceptual projects that need further development.

The Rolling Action Plan will undergo updates annually, with the goal of advancing projects through each category—promoting items from List C to B, and B to A—as their planning matures. This adaptive approach allows the strategy to remain responsive to both immediate and long-term surveillance needs and integrates seamlessly into the Annual Development Plan (ADP) and operational budget processes.

# 4 AMU Surveillance Strategic Framework

**Outcome 1: Optimized Antimicrobial Use in Healthcare Settings**

**Objective:** Ensure rational and evidence-based use of antimicrobials in hospitals, clinics, and other healthcare settings to reduce overuse and prevent antimicrobial resistance (AMR).

| Outputs | Activity |
|---|---|
| **1.1 Antimicrobial Stewardship Programs (ASPs)** | Establish ASPs in hospitals as per WHO GLASS recommendations, ensuring that the ASPs are in line with the WHO's core components for antimicrobial stewardship. Expand from five hospitals in Year 1 to 50 hospitals by Year 5, ensuring that monitoring and feedback loops for ASP activities are standardized across the healthcare settings. |
| **1.2 Prescription Monitoring System** | Implement an electronic system for real-time monitoring of antimicrobial prescriptions with full compliance to WHO GLASS data protocols. This will facilitate the monitoring of the volume and types of antimicrobials used, supporting surveillance and decision-making. Expand to 50 hospitals by Year 5 and ensure that all facilities comply with WHO-defined data collection protocols. |
| **1.3 National Treatment Guidelines** | Align national treatment guidelines with the most recent WHO recommendations and the WHO AMR surveillance system. Guidelines should undergo regular reviews every two years to reflect evolving antimicrobial resistance patterns and emerging pathogens. |
| **1.4 Capacity Building for Healthcare Workers** | Ensure that healthcare workers are trained on WHO GLASS data collection methodologies and the principles of antimicrobial stewardship. Incorporate WHO's global recommendations on AMU in training, with refresher courses and updates provided regularly to healthcare professionals at all levels. |
| **1.5 Clinical and Pharmacy Audits** | Establish periodic audits with a focus on WHO AMU and AMR data collection standards. These audits should assess both antimicrobial prescription patterns and pharmacy practices in alignment with WHO AMR guidelines. Scale the audits to 50 hospitals by Year 5, with clear feedback mechanisms to improve AMU practices. |

**Outcome 2: Comprehensive AMU Surveillance Data Collection and Reporting Systems**

**Objective:** Establish a robust data collection and reporting framework to monitor antimicrobial use in healthcare settings, allowing for informed policy decisions and intervention strategies.

| Outputs | Activity |
|---|---|
| **2.1 Electronic Data Collection System** | Develop and implement a scalable electronic AMU data collection system that follows WHO GLASS technical guidelines. The system must be compatible with existing national health information systems and allow for integration with WHO's AMR data reporting tools. The system should include all required data points for global surveillance. |
| **2.2 Standardized Data Protocols** | Standardize AMU data collection protocols to ensure they align with WHO's GLASS data requirements. This includes harmonizing definitions, data categories (e.g., DDD, ATC codes), and methods of reporting to ensure international comparability and accuracy. Provide training to all involved personnel on protocol compliance. |
| **2.3 DHIS2 Integration** | Integrate AMU data collection into the District Health Information Software 2 (DHIS2), ensuring full compatibility with WHO GLASS and making AMU data part of the national health information system. Customize the platform to track the specific indicators required for AMU surveillance. |
| **2.4 Public and Private Sector Coverage** | Extend AMU data collection to include diverse healthcare facilities in both the public and private sectors, ensuring comprehensive data coverage. This expansion should align with the WHO's objective to collect representative data from various healthcare sectors. |
| **2.5 Standardized Reporting Framework** | Develop a standardized reporting framework for AMU data that is compatible with WHO GLASS standards. The framework should facilitate the reporting of trends, antibiotic consumption, and resistance patterns to relevant stakeholders and enable data-driven decision-making. |
| **2.6 Data Validation and Quality Control** | Implement stringent data validation and quality control procedures in line with WHO GLASS guidelines. Conduct periodic audits and technical support interventions to improve data accuracy and reporting consistency. |

**Outcome 3: Improved Data Analysis and Use for Decision-Making**

**Objective:** Analyse AMU data effectively to identify trends, gaps, and opportunities for targeted interventions and inform evidence-based policy decisions.

| Outputs | Activity |
|---|---|
| **3.1 Data Analysis Framework** | Develop a robust data analysis framework that uses WHO's methodology, such as ATC/DDD analysis, to assess antimicrobial use across healthcare settings. Ensure that the framework provides insights into antimicrobial consumption trends, resistance patterns, and emerging threats. |
| **3.2 Capacity Building** | Provide training workshops on AMU data analytics using WHO-recommended tools and methods. Train clinicians and data analysts to use WHO's data analysis and visualization tools to generate actionable insights from AMU surveillance data. |
| **3.3 Reporting and Dissemination** | Establish clear, standardized reporting schedules and disseminate findings in line with WHO GLASS reporting requirements. Reports should be shared with |

| Outputs | Activity |
|---|---|
| | relevant national and international stakeholders, including policymakers, to guide AMU interventions and policymaking. |
| **3.4 Feedback Loop** | Develop a feedback mechanism that ensures timely dissemination of AMU analysis findings to healthcare providers. This should be based on WHO GLASS's best practices and ensure actionable recommendations for improving prescribing practices. |
| **3.5 Monitoring and Evaluation (M&E)** | Implement a robust M&E framework that incorporates WHO GLASS's indicators for assessing the impact of AMU surveillance interventions. Use regular M&E findings to refine AMU strategies, policies, and interventions. |

**Outcome 4: Strengthened Policy Framework, National Coordination, Communication and Reporting**

**Objective:** Foster coordination among government, healthcare institutions, and stakeholders for coherent policies and strategies for AMU surveillance and control.

| Outputs | Activity |
|---|---|
| **4.1 National Steering Committee** | Establish a steering committee that aligns with WHO's AMR coordination guidelines. This committee should be tasked with overseeing the national AMU strategy, ensuring WHO GLASS requirements are adhered to in national and provincial AMR strategies. |
| **4.2 Policy Integration** | Integrate AMU surveillance findings into national policies that reflect WHO's AMR action plans. Ensure policies align with WHO AMR and GLASS recommendations and prioritize data-driven interventions. |
| **4.3 Public-Private Collaboration** | Strengthen collaboration between the public and private sectors to harmonize AMU data collection, reporting, and intervention strategies. Joint efforts should comply with WHO GLASS and foster transparency in data sharing. |
| **4.4 Regulatory Framework** | Review and update regulations on antimicrobial prescribing and use, based on WHO GLASS's recommendations. Focus on ensuring regulatory practices are aligned with global standards for high-risk antibiotics and antimicrobial stewardship. |
| **4.5 Stakeholder Engagement** | Organize stakeholder workshops and consultations to discuss AMU surveillance results in the context of WHO AMR objectives. Use these platforms to share best practices and align AMU strategies with international standards. |